TO: **David Spergel, Chair, Space Science Advisory Committee**

FROM: **Jonathan I. Lunine, Chair, Solar System Exploration Subcommittee**

SUBJECT: **Solar System Exploration Subcommittee Meeting**

The Solar System Exploration Subcommittee (SSES) of the Space Science Advisory Committee (SScAC) met February 14-15 at the Santa Fe Institute, Santa Fe, NM. The purpose of this memorandum is to summarize the findings of that meeting and ask SScAC to consider them and transmit its recommendations to Mr. Andrew Dantzler, Director of Solar System Exploration.

Administrative

SSES reiterates its concern expressed in the last letter to SScAC (October 2004) about the multitasking of high-level personnel into several duties simultaneously. The work overload among NASA personnel was strongly evident at this meeting and in the weeks preceding it. SSES believes this is leading to a detrimental stressing of the system, delays in programming, and burnout of personnel. SSES asks SScAC to recommend in the strongest terms to the Associate Administrator for the Science Mission Directorate that he fully staff offices at the program level to address the programmatic challenges ahead.

Discovery

The SSES notes that the Discovery-11 selections were limited to a highly meritorious Mission of Opportunity instrument proposal (MMM) for the Chandraayan-1 payload. The proposals submitted for full missions were judged unlikely to be successful within the current Discovery Program cost caps and schedule constraints. SSES recognizes that the remaining funds from this recent competition will increase program flexibility in the Discovery-12 selection process, and applauds NASA's efforts to re-structure the Discovery Program to address schedule and other concerns, including the rapidly escalating cost of launch vehicles.

In the longer term, SSES shares the concern of current Discovery PI's about some aspects of programmatic support. In particular, there remain significant issues with long-lead procurements and the interaction of mission PI's with essentially "sole source" suppliers, issues that need to be taken into account when costing and evaluating proposals. On the positive side, SSES is pleased to note that the Discovery Program Office at MSFC appears to be working well, and is providing needed support in analyzing and mitigating mission development risks. The SSES supports an active role for the Discovery Program Office in assisting PI's to manage areas of potentially significant mission risk.

JIMO/Europa orbiting mission

As of this writing the Jupiter Icy Moons Orbiter (JIMO) mission has been delayed indefinitely. In its past letters to SScAC, SSES has said that a launch of JIMO beyond

2015 would unacceptably push Europa exploration beyond the Solar System Exploration (SSE) Decadal Survey horizon and introduce an unprecedented hiatus in outer solar system exploration. Europa is of great astrobiological interest because the satellite is believed to possess a huge reservoir of subsurface water and, plausibly, the chemical energy required to nourish life. In the words of the Decadal Survey: "The first step in understanding the potential for icy satellites as abodes for life is a Europa mission with the goal of confirming the presence of an interior ocean, characterizing the satellite's ice shell, and understanding its geological history." To this end, the SSE Decadal Survey recommended a Europa Geophysical Explorer as the highest priority mission in a Flagship cost class.

The Decadal Survey's recommendations are still compelling today, and we reiterate the extremely high priority of Europa exploration and the expected paradigm-altering advances in knowledge regarding icy satellite habitability. In the increasingly likely event that JIMO is dead, an orbiting spacecraft remains the prudent and proper approach to characterization of Europa. In view of this, it is essential that NASA move forward as rapidly as possible with development of a Europa orbiting mission.

Mars

The SSES commends the Mars Exploration Program (MEP) on the outstanding success of the MER missions and supports efforts to continue the scientific investigations by the Opportunity and Spirit Rovers past the current extended mission ending March 15, 2005. SSES is extremely pleased that the payload for the first Mars Science Laboratory (MSL) has been selected, a milestone on the way to getting MSL-1 launched.

With regard to the ongoing road-mapping activities related to Mars, the SSES believes that the strategic planning to date by the MEP has provided a sound foundation for the broader planning in support of the National Vision for Space Exploration. As the planning process for the next decades of Mars Exploration moves forward, the SSES wishes to emphasize the importance of PI-led Mars Scouts in the mix of missions. By competing diverse lines of investigation that can respond quickly to new scientific discoveries in a way that mainline missions cannot, Mars Scouts can achieve compelling science while providing a broader context for understanding Mars and whether life ever developed there. SSES has learned that in the current roadmapping process, the role and nature of the Scout missions is being reexamined. It is important that these missions not devolve into another set of directed missions nor be squeezed out by the expense of the directed program of mainline missions.

Lunar Program

The Moon has remained a subject of intense scientific interest as it contains clues to the origin and earliest history of our home planet. In addition, rocks on the surface of the Moon may maintain a record of the early dynamics of the lunar interior and formation of

the lunar crust. Under the National Vision for Space Exploration, the Moon is seen both as a potential source of resources and as a critical path in future human exploration of the Solar System. Based on its importance to both planetary science and human exploration, NASA has formed a Lunar Program within Solar System Exploration. This office, in consultation with the Exploration Mission Directorate and the Chief Scientist, will implement the robotic lunar exploration program. SSES is very pleased that the Lunar Reconnaissance Orbiter (LRO) has been defined, and instruments of high science value have been selected for a 2008 launch. A second exploration mission is planned in the 2009/2011 timeframe. A major challenge to this program remains the distribution of management across the Science Mission Directorate, Exploration Mission Directorate and Chief Scientist offices. It is imperative that the Lunar Program pursue the highest return in terms of science data from all instruments and missions under its purview.

Community involvement in the lunar program has been predominantly through a series of meetings of a group encompassing the lunar science, *in-situ* resource utilization (ISRU), space biology and engineering communities, which now form the nucleus of the Lunar Exploration Analysis Group (LEAG). This group will provide advice and direction to NASA on future lunar mission activities. It is critical that the broader communities of lunar scientists and ISRU engineers, in particular, become engaged very soon in the process of mission development and definition. The expanded community involvement will assure that the future lunar exploration missions address high-priority science and resource exploitation issues.

Research and Analysis and New Technology Programs

SSES is concerned about the decrease in real dollar value of the research and analysis (R&A) and technology programs in Space Science. R&A programs enable the nation to fully realize the value of data sets returned by the remarkable array of flight missions ongoing and that have been completed in the past, as well as to pave the way for new flight programs that are envisioned as part of the current roadmapping effort. Unique efforts of scale, such as the multifaceted NASA Astrobiology Institute with its diverse ongoing programs involving mission conceptualization, data analysis, fieldwork, and education in astrobiology, can be particularly vulnerable in this environment. Although it is tempting to reduce such programs to offset development issues elsewhere in the agency, the net result is a loss of value in the highly productive Space Science program.

Investment in new technologies is essential to maintain or increase capabilities in exploring the solar system, across the entire spectrum of mission classes. In long-term programs such as Discovery and New Frontiers, the ability to address the highest priority science goals will decline with time unless new technologies are injected into the programs. For example, the development of ion propulsion and spectrometer grating technologies that were flight-proven (on New Millenium DS-1) enabled the use of these technologies on Discovery missions (Dawn, MMM). SSES believes that new technology programs must continue to be supported at an adequate level, and urges that SScAC pay

attention to the issues both of support for the new technologies program and the means by which the technologies are infused into new missions.

The committee heard a presentation from Michael New (NASA HQ) on the time-to-funding of R&A grants under the Solar System Program. Concerns raised by the Planetary Systems Science Management Operations Working Group that delays in funding might have a particular cause that could be addressed motivated the study. The result indicated strongly no particular trend as a function of program element; for example, there was no clear correlation with number of proposals and the proposal due dates. Instead, the delays seemed to be stochastic, but ultimately are tied to the very heavy workload of HQ staff in multitasking various roles. The result reinforces the conclusion in the section on "Administration" that HQ is understaffed and personnel are overcommitted in the roles they must play.

Competitive selection

SScAC should reaffirm the long-standing commitment of the scientific community to rigorous peer review and competitive selection of spacecraft missions, instruments, and research investigations. This core principle depends for its success upon the efforts, and the confidence, of a large fraction of the scientific community in the peer review process The SSES strongly opposes avenues of support, such as earmarks, that subvert the process and outcome of open competition and peer review, ultimately undermining and endangering the long-term vitality of solar system exploration.

Sincerely

Jonathan I. Lunine, Chair